

**Water-Saving Instruments for the Fresh Pond Golf Course and Cambridge
Tree-Waterers**

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Proposal

Per year, over 2 [billion](#) gallons of water are used per day to irrigate golf courses in America; water runoff contributes to damaging soil erosion and chemical poisoning in nearby environments. To date, 2 [million](#) acres of land and natural habitats have been destroyed to be developed for golf courses in the United States. To address some of these concerning numbers, we began to delve into technologies that could reduce the water waste in golf courses across the US. Soon it became clear that irrigation systems and turfgrass were the biggest contributors to water waste.

Since Cambridge, MA, has a municipally-owned golf course, we aimed to learn more about the course in Fresh pond, and identify technologies to reduce water waste. We soon set up a tour with the Superintendent of the Fresh Pond Golf Course and learned about the importance and structure of water irrigation systems, statistics on water usage, and the overall function of the golf course. Superintendent Martin informed us of the outdated state of their water irrigation system and its lack of efficiency with detecting proper transpiration, using a surplus of water at an inefficient rate over the year. This statement remained in line with our research on irrigation systems, which continue to be a large contributor to water waste on many golf courses.

Thus, the CRLS student-led Glocal team, *Putting Away Water Waste*, proposes an investment into instruments that improve water efficiency for staff of the Fresh Pond municipal golf course. Currently, the Fresh Pond golf course is not optimally water efficient. There are a number of factors that contribute to this: the irrigation system is antiquated (it has not been updated since the 1970s), the pipes have a narrow diameter due to constant repairs (preventing the target amount of water pumped out from the pump house from reaching the soil), and the grass types that have the highest amount of water retention are unable to grow due to the shady nature of the course (trimming of the trees is very limited due to conservation regulations on the famous landscape architect Frederick Law Olmstead's course). The irrigation system is costly to replace, in the millions of dollars, the grasses require major

re-landscaping, which is also very expensive and time-consuming, and the water efficiency of the irrigation system on the course is difficult to track due to the narrow pipes. Therefore we recommend investing in ways to accurately gauge how much water is needed to pump out to avoid overcompensating, which is less costly than a major irrigation system replacement or relandscaping. Instruments such as a weather station and advanced soil moisture meters can gauge the level of water required to water turfgrass accurately. Currently, the staff do not have advanced evapotranspiration tools and rely on rough estimates. While other improvements are incredibly costly, these instruments can enable Fresh Pond Golf Course staff to gauge the amount of water needed for the greens accurately without requiring the management to go over budget.

In the same proposal, we also recommend investments into tools for municipal tree watering staff. These staff travel across Cambridge, via bike, and individually water trees on city property. This arduous job requires high attention to the water needs of Cambridge trees, and we believe that an accurate read on how much water trees require might allow the tree-waterers to complete their task more efficiently, but also with more ease. If an instant-read on how much water the roots require is available to waterers in a portable, convenient way, the tree waterers can avoid over-watering, and therefore save water. This can be possible with the purchase of ten advanced and inexpensive moisture meters. Less advanced than the turf-grass specialty meters, these portable meters are deeper, measuring at 36 inches, and can make instant measurements about deep-ground soil moisture—which is optimal for watering trees.

For all of these proposed products, we outline the fiscal benefits, product reviews, and the uses and benefits that they will provide groundskeepers below. Through this, we'll also outline the predicted metrics of water saved. An investment in these water efficiency tools will allow for long-term fiscal benefits, creating more leniency in capital budgets in the long term.

Introduction

In Cambridge, We have a municipally-owned golf course, so we decided to begin our research into a more efficient system here at home. To tackle water waste for golf courses locally, investing in more efficient irrigation technology should be the main priority to compensate for the fifty year old irrigation system as it does not currently provide accurate information for staff to water the Fresh Pond Golf Course. Over the past decades, research on water efficiency has greatly improved our understanding of how traditional systems of irrigation could be made more water-efficient. One focal advancement for irrigation technology is the capacity to detect water transpiration rates—the rates at which water evaporates naturally from the ground—and how they change depending on the temperature, perspiration, and humidity during a particular day of irrigation. Water irrigation systems without this aforementioned capacity use the same amount of water and irrigation time intervals for all areas of grass on a golf course, regardless of their differing levels of evaporation and specific requirements. Using equal amounts of water for areas of grass with vastly different rates of transpiration results in millions of gallons of wasted water per year, costing the city unpredictable amounts of money than what is truly necessary to maintain the grass at the Fresh Pond Golf Course.

According to the Fresh Pond Golf Course Superintendent, the output of the water spout heads is currently 35 gallons per minute when the pump house is activated. Yet, the output is supposed to be twice this yield or around 70 gallons per minute. Moreover, considering that the net output of the pumphouse is around 20 million gallons per year, the water that does not reach the greens and spout heads is vast, approximately 50% less than it should be. Considering the repairs that the Fresh Pond Golf Course has had to do on the pipes (the 4-inch pipes are now the diameter of 2-inch ones), it is clear that water is being prevented from truly hitting the course. In order to address this, without replacing the pipes or irrigation system, there are some solutions.

Moisture Detector Technology Investments

Fresh Pond Golf Course: Weather Station

Currently, the Fresh Pond Golf Course uses a general and fairly inconsistent website to estimate the ever-varying weather and transpiration points in the surrounding area. The installation of a small local weather station to calculate the evapotranspiration, wind speed and direction, rainfall, dew point, solar radiation, air temperature, and relative humidity, will enable the Fresh Pond Golf Course to accurately measure how much water they must use to irrigate their greens.

We propose the [WatchDog 2900ET Weather Station](#)

Price: \$2,150.00, with an additional \$199.00 for accompanying software



Fresh Pond Golf Course: High-tech Turfgrass Moisture Meters

Additionally, the Fresh Pond Golf Course will further benefit from less extensive and more portable technology to monitor moisture levels, temperature fluctuations, and evapotranspiration rates between various locations on their course. This movable option will allow them to adapt their levels of water irrigation based on the specifics of each dedicated area of the Golf Course. A comparatively lower-priced penetrating detection system will improve water efficiency throughout their irrigation procedure, save millions of gallons of water per year, and reduce water and electricity costs for the city.

We propose [2 FieldScout TDR 350 Soil Moisture Meters](#)

Price: \$1,495.00 each, a total of \$2,990.00 for the purchase of 2

Use and Efficiency:

“The TDR 350 accurately measures soil moisture across the full range of soil conditions. Improved ergonomic design provides quick and easy measurements. Validate your cultural practices with hands-free data collection integrated with Bluetooth and GPS”(Spectrum Technologies)

Features include:

- Increased accuracy of soil moisture (Volumetric Water Content)
- Measures EC (Electrical Conductivity)
- Measures Turf Surface Temperature
- Integrated Bluetooth and GPS
- The data logger records approximately 50,000 measurements
- Industry-exclusive backlit display
- Improved shaft-mounted probe with telescoping tubular frame

- Data collected with USB flash drive
- No PC interface needed
- Powered by AA lithium batteries

“The FieldScout TDR 350 is the next generation to the TDR 300 series soil moisture meter. The new enhancements to the TDR 350 include EC (Electrical Conductivity) measurement, turf surface temperature measurement, an improved backlit display, integrated Bluetooth, and internal GPS. In addition to offering the proven time-domain measurement technology that turf professionals have come to trust in the FieldScout TDR brand. The FieldScout TDR 350 soil moisture sensor takes into account EC readings and integrates that reading into the TDR results, giving consistent readings no matter if the soil EC level is higher or lower”(Turf-Tec International)



Cambridge Water-By-Bike Tree Ambassador Interns: Moisture Meters

In early 2021, the Cambridge Public Works Department (DPW) posted a [job listing](#) titled *Water-By-Bike Tree Ambassador Interns (8 Positions, Seasonal)*. These Water-By-Bike Tree Ambassador Interns will travel around the City of Cambridge by bike, inspecting, watering, and maintaining selected trees for almost 40 hours a week each. In order to conserve water, reduce costs for the city, and maintain a more environmentally friendly process to water the trees, the 8 interns can use portable, lightweight, and simple moisture meters to determine if a given tree is ready to be watered. This way, the interns can accurately gauge how much water to retrieve for each tree, not only making their task more efficient and increasing the health of the trees—but also saving water in the process.

We propose [10 REOTEMP Garden and Compost Moisture Meters \(24 inches\)](#)

Price: \$53.00 each, a total of \$530.00 for the purchase of all 10. Note that there is a 15-inch option if portability is a concern. Still, a two-foot lightweight moisture meter is likely portable considering the interns have bikes equipped to carry heavy loads and tools.

Use and Efficiency:

“Used by composters, farmers, and nurseries across the country, the REOTEMP 24” Garden and Compost Moisture Meter is perfect for measuring the moisture of tree roots, soil, and compost piles. The unit is easily user-calibrated to an “ideal” moisture level, as chosen by the user. This flexible calibration feature allows the REOTEMP moisture meter to be customized to a diverse number of applications. From fruit trees to tomatoes or compost, you decide what your ideal moisture level is with a turn of the calibration screw on the back of the unit. Just get your soil or compost to the moisture level that works for you and adjust the needle to a “5” on the 0 to 10 scale. Then, when you come back again to check your compost or soil

you'll know if it's too dry or too wet. If the reading is above "5" it's too wet, if it's below "5" it's too dry"(REOTEMP Amazon product description).



Supporting Data and Reviews:

On the Amazon website, the REOTEMP Meters have an average of 4.1 out of 5 stars. The majority of buyers who had purchased the product were looking to better determine when to water their lawns and trees, with the wide majority stating they were successful at this objective. Most reviews say the technology was easy to use and calibrate for different types of plants, with simple instructions provided. The technology was genuinely impressive to gardeners who had become weary of cheaper, inaccurate, and flimsy moisture meters with which they had previously experimented. The red, blue, and green colors on the moisture reading were beneficial to the average user in gauging when the plant was in severe need of watering or even too hydrated. Finally, most reviews stated that the REOTEMP Meter was always accurate and dependable for good reading.

Total Cost of Instruments

The total sum of the WatchDog 2900ET Weather Station, the two FieldScout TDR 350 Soil Moisture Meters, and the ten 24-inch Garden and Compost Moisture Meters is **\$5,869**. These tools cost 1.1% of the total \$500,000 Cambridge Participatory Budget from 2020. Compared to the average 2020 Participatory Budgeting Proposal cost of \$73,000, an investment in these instruments would be more than 12 times less pricey.

Our team acknowledges the standard cost of Participatory Budget Proposals is rounded to the thousands of dollars, so a simplification to **\$6,000** for all tools outlined would be reasonable.

Conclusion

Water efficiency is our main priority, and this is reflected in our proposal. Still, we sought to ensure that these tools could truly be a convenience to municipal employees rather than hinder them. In this way, these relatively simple tools and methods of water conservation have benefits on two fronts: helping the environment and helping Cambridge workers. As Cambridge residents, we believe feasible solutions and incremental improvements is the best path towards making a difference in Cambridge. The City of Cambridge has made significant strides in recent years to reduce our environmental footprint and shift to more sustainable practices that our government can realistically invest in. Our community has long recognized issues in local maintenance or resource management that could be reformed to produce long-term environmental benefits, and funding new evapotranspiration technology to reduce waste when watering local greenery is the next step in this journey. Thus, it is clear that these relatively inexpensive tools should win in the upcoming 2021-2022 Cambridge Participatory Budgeting year.